A STUDY OF THE SPINAL CORD OF A SPRING-HALT HORSE.[1]

THE horse from which this cord was taken had belonged to a farmer living near Boston. The animal was about twenty years old and was known to have been afflicted with spring-halt five or six years before 1891, when it was destroyed. During this time it had grown continuously worse, and at the time of its destruction it was practically worthless. The attention of Dr. L. H. Howard, President of the Massachusetts Veterinary Association, was called to the animal in the summer of 1889. He gives this description of its symptoms and efforts at locomotion at this time: "The animal, on being moved, would pick up each hind leg with a quick, jerky motion, characteristic of spring-halt, but the great excess of motion seemed to be that of abduction; the whole limb would fly out away from the body, so much so that he would sometimes hit it against the shafts of the vehicle to which he was harnessed. The foot came back to the ground, however, in proper advance of the point of leaving it, and progression was accomplished after the animal was once in motion. The muscular contractions quickly diminished until they became nearly normal, and did not take place again while he was trotting. On dropping his gait to a walk, they would sometimes occur again for a few steps; when he had come to a standstill, then always on starting again the above-described movements would take place. These symptoms all the time increased until the animal came into our possession in the summer of 1891. He had then become an exaggerated case. The motion of abduction was now so excessive that he would throw the first limb lifted so high that he would lose his balance, and be obliged to hop on the opposite limb, when that in turn would fly out and up so high that over he would balance on the first one again, and thus he would 'dance the ballet' for several seconds before being able to progress at all. Finally the excessive contractions would subside enough so he could step forward, and he would trot off all right for a longer or shorter distance, when he would have to stop and again have his 'dance.' In some instances the throwing up of the limb would so overbalance him that he would fall to the ground. If moved suddenly in a stall of ordinary width, he would strike first one side of it and then the other several times with his hoofs." In June of 1891, the animal was placed in charge of Dr. Howard for experiment. He invited several veterinary specialists, who were interested in spring-halt and who had theories of the nature of the disorder, to try their treatment upon the animal and supplied the means for doing so. Dr. Bryden alone accepted the invitation. He made a careful examination, and diagnosed the case as a disorder resulting from defective hoofs. This belief that a defective hoof was the cause of spring-halt he had been led to by his father more than thirty years before. This is his description of the animal and its pathological symptoms:

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[1] An abstract of a paper read by T. L. Bolton before the Massachusetts Veterinary Association, at Boston, June, 1892.

"The horse was a small black pony, about fourteen hands high, and twenty years old, apparently well enough, with the exception of hind legs, which were badly afflicted with spring-halt, both legs being nearly, if not, quite alike. In viewing the animal from behind, the crests of the illium were not even. The glutials were both alike flat, and the hips drooping, and the sacrum and tail elevated and coarse; the muscles to the stiffle were somewhat wasted; the muscles behind the tibia were small, and felt like tendons to within two or three inches of their origin. The hocks were both coarse, but not more than ought to be expected under the circumstances; his age and the way he had been used for sometime having tended to produce changes; both had a small elevation or slight coarseness at the seat of bone spavin. His legs below the hocks were always swollen, from the fact that when he attempted to move in his stall he struck his ankles against the sides with such force as to make and keep them sore."

Most of these symptoms will be recognized immediately as common to all cases of spring-halt. Dr. Bryden believing that hoofs were the primary cause, and that these other symptoms resulted from the disordered hoofs gave special attention to them. He says:

"They were smaller than nature had intended them to be, and very nearly round; the wall short and very thick, the sole low, the bars strong, the heels short, and the frog of medium size. The horn seemed fairly healthy, but it grasped the extremity like a vise, causing him much uneasiness."

Dr. Bryden began his treatment upon the theory that the above-described symptoms were due entirely to the compression which the too small hoofs exerted upon the nerves and blood-vessels supplying the lower extremity. The hoofs were thinned and pared down and the frog thoroughly cleaned, and kept so. The details of his whole treatment are unnecessary. It will be sufficient to say that after two months' care and treatment the animal improved greatly. Dr. Howard says of this treatment, "that it caused a certain decrease of the excessive motion described, and we saw him on two or three occasions even start off without his customary introducing 'ballet.'" The recovery was not complete, and the treatment does not seem to have given evidence that the animal would ever have completely recovered, for it was destroyed. The spinal cord was taken out and sent to Dr. H. H. Donaldson, Assistant Professor of Neurology at Clark University. He placed it in my hands and under his direction it has been examined with a microscope.

The specimen consisted of a section of the cord extending from the level corresponding to the eleventh dorsal vertebra to the termination of the cord in the sacrum. The portion of the cord caudad of the origin of the fifth pair of lumbar nerves was so badly bruised in the process of removal from the vertebra that it was unfit for microscopical examination, save the roots and ganglia of the first and second pairs of sacral nerves which were held intact by the dura mater. In addition to this were the roots and ganglia of the fourth, fifth, and sixth pairs of lumbar nerves. The whole specimen was hardened in a 2–5 per cent. solution of bichromate of potash plus one-sixth its volume of 95 per cent. alcohol. In this fluid it remained for two months, when sections were taken from six different levels of the cord, and also the roots and ganglia of the fourth, fifth, and sixth pairs of lumbar, and of the first pairs of sacral nerves, and completely hardened in strong alcohol. These specimens were then numbered to preserve the order, and sectioned. In staining, two purposes were kept in view: the first to show the fibres, and the second to show the cells. For fibre staining the best results were obtained with a double stain of palladium chloride and ammonia carmine. Other fibre stains were nigrosin, acid fuchsin and carminic acid. The most satisfactory cell stain was a double stain of Delafield's hæmatoxylin, and Van Giesen's picro-fuchsin. As the cells did not show a regular and marked degeneration, we need not concern ourselves with them. The fibres alone seem to have undergone a regular degeneration. Beginning with the sections from the level of the eleventh dorsal nerve and proceeding caudad, the location of the degenerated nerve fibres will be pointed at the successive levels where specimens were taken. On a section from the level of the eleventh dorsal nerve, a lesion appears in both the dorsal and ventral columns. In the dorsal columns it has a grosser appearance, and is not so diffuse as in the ventral columns. Large numbers of fibres have entirely disappeared from the region about both posterior horns of the gray matter. The degenerated areas are not quite symmetrical in the right and left halves of the cord. In the ventral columns the degenerated fibres appear singly as a rule, and are distributed around the periphery of the anterior columns as far as the points of entrance of the anterior roots of the spinal nerves. There are in addition more or less degenerated fibres distributed throughout the entire section. The appearance of the section from the level of the first lumbar vertebra is similar to that from the level of the eleventh dorsal. In the posterior columns the lesion is somewhat more marked, but in the anterior columns it is less marked and not so closely confined to the periphery. On the section from the level of the fourth lumbar vertebra, no lesion, properly speaking, appears in the anterior columns, but it is perfectly plain in the posterior columns and involves a larger area of the section. The location about the posterior columns is about the same as on the other sections. As the animal was old and had been subjected to hard usuage, the degenerate fibres in the anterior columns may have no pathological significance. The disturbance in the posterior columns is certainly significant of something more than the decay resulting from old age and hard usage. It is confined entirely to the sensory areas. The first indication of any degeneration is the failure of the myelin substance to receive a stain, and not unfrequently the fibre that fails to stain is swollen. The axis-cylinder is next to disappear, and finally the medullary sheath, leaving an unstained gap in the section. A section was allowed to remain in nigrosin for twelve hours, and no stain of these areas was affected. These unstained areas can easily be seen without a glass, and was first noticed on an unstained section from which the alcohol was allowed to evaporate.

The results of the examination of sections taken from the ganglia of the fourth, fifth, and sixth pairs of spinal nerves are perhaps more interesting still. The ganglia were sectioned at intervals of one-eighth of an inch, and the order of these sections carefully maintained. The same methods of staining were used for these as for the sections from the cord. The most peripheral section of one ganglion showed that a single funiculus in the motor region had undergone complete degeneration. Proceeding toward the cord the successive sections showed that this funiculus became gradually broken up and distributed throughout the whole motor area of the section, for the degenerated fibres were found scattered in every part of the motor area. Although the disturbance in the cord was mostly confined to the sensory area, it is the motor fibres in the nerves that have suffered decay. No very careful and detailed study of the blood-vessels has been made, so that it cannot be definitely stated whether or not the lesion has resulted from a lack of blood supply. It is not deemed expedient to attempt to argue the consistency of a sensory degeneration in the cord and a motor degeneration in the spinal nerves. It is my purpose simply to state what appear to be the facts in regard to the condition of this cord. We have simply a coincidence: a horse is afflicted in a high degree with spring-halt, and a lesion has been found in the sensory areas of the cord and in the motor areas of certain nerves which control the hind limbs. Some veterinary surgeons have long supposed a central origin for the disease, or at least that the disease was nervous. The disease has resisted up to the present time all attempts at a cure, and the sale of a horse is greatly injured when it is known to be afflicted with spring-halt. As a means of getting a better understanding of the symptoms of spring-halt, I would suggest a careful study of the cutaneous sensibility of the hind limbs. The history of the animal is also important in determining the cause.

Before closing this paper I wish to enlist the services of the members of this Association in obtaining further material for finishing a work that appears at present promising. I will take it upon myself to examine any material sent to Clark University, Worcester, Mass., and report the results of the examination to the person who sends it. The cord after being taken out (and the whole cord is desired) should be placed in a 2–5 per cent. solution of bichromate of potash plus one sixth its volume of 95 per cent. alcohol, and expressed to the above address.